इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 15748 (2007): Textiles - Protective clothing for industrial workers exposed to heat (excluding firefighters' and welders' clothing) [TXD 32: Textiles Protective Clothing]

"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

BLANK PAGE

BRUTUM FULMEN

IGNORANTIA JURIS NON EXCUSAT

PROTECTED BY COPYRIGHT

भारतीय मानक

वस्त्रादि — औद्योगिक मजदूरों के लिए गर्मी से बचाव के लिए सुरक्षा वस्त्र (आग बुझाने वालों और वेल्डरों के वस्त्रों को छोड़कर)

Indian Standard

TEXTILES — PROTECTIVE CLOTHING FOR INDUSTRIAL WORKERS EXPOSED TO HEAT (EXCLUDING FIREFIGHTERS' AND WELDERS' CLOTHING)

ICS 13.340.10

© BIS 2007

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

December 2007 **Price Group 5**

Chemical Methods of Test Sectional Committee, TXD 05

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Chemical Methods of Test Sectional Committee had been approved by the Textile Division Council.

This standard is applicable to protective clothing for industrial workers exposed to heat (excluding firefighters' and welders' clothing). The clothing consists of outer garments made from flexible material to protect specific parts of the body. Hoods and gaiters are included but all other types of protection for the head, hands and feet are excluded.

This standard specifies the performance requirements and methods of test for the protective clothing materials and gives design recommendations for the clothing where necessary. Protective clothing complying with this standard is intended to protect industrial workers against brief contact with flame and against at least one type of heat. The heat may be in the form of convective heat, radiant heat, large molten metal splashes, or a combination of these heat hazards.

The composition of the Committee responsible for the formulation of this standard is given in Annex C.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

TEXTILES — PROTECTIVE CLOTHING FOR INDUSTRIAL WORKERS EXPOSED TO HEAT (EXCLUDING FIREFIGHTERS' AND WELDERS' CLOTHING)

1 SCOPE

This standard is applicable to protective clothing for industrial workers exposed to heat (excluding firefighters' and welders' clothing). The clothing consists of outer garments made from flexible material to protect specific parts of the body. Hoods and gaiters are included but all other types of protection for the head, hands and feet are excluded.

This standard specifies the performance requirements and methods of test for the protective clothing materials and gives design recommendations for the clothing where necessary. Protective clothing complying with this standard is intended to protect industrial workers against brief contact with flame and against at least one type of heat. The heat may be in the form of convective heat, radiant heat, large molten metal splashes or a combination of these heat hazards.

2 REFERENCES

The standards given below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards:

IS No.	*Title*
15758	Textiles — Protective clothing:
(Part 1) : 2007	Method of determining of heat transmission on exposure to flame
(Part 2) : 2007	Assessment of material assemblies when exposed to source of radiant heat
(Part 3) : 2007	Test method for limited flame spread
(Part 4) : 2007	Assessment of resistance of materials to molten metal splash
14453 : 1997	Size designation of clothes — Definition and body measurement procedure
15612 (Part 2) : 2005	Textiles — Burning behaviour of curtains and drapes: Part 2 Measurement of flame spread of vertically oriented specimens with large ignition source
15370 : 2005	Textiles — Domestic washing and drying procedures for textile testing

3 TERMINOLOGY

For the purpose of this standard the following definitions shall apply.

3.1 Harm — Physical injury or damage to the health of people.

3.2 Hazard — Potential source of harm.

NOTE — There are different general type of hazards, for example, mechanical hazards, chemical hazards, cold hazards, heat and/or fire hazards, biological agents hazards, radiation hazards. Certain of these type of hazards can, according to circumstances, derive from more specific hazards. Thus, a heat hazard can derive from contact heat, etc, and for each of which there may be separate test methods. Particular garments have been designed to give protection against the hazards encountered in specific type of work. Examples of such garments are aprons that provide protection against hand knives, trousers for use with chainsaws, clothing for protection against foul weather, high visibility clothing and motorcycle rider's protective clothing.

3.3 Risk — Combination of the probability of occurrence of a harm and the severity of that harm.

3.4 Protective Clothing — Clothing which covers or replaces personal clothing, and which is designed to provide protection against one or more hazards.

3.5 Level of Performance — Number that designates a particular category or range of performance by which the results of testing can be graded.

NOTE — Since levels of performance are based upon the results of testing in a laboratory, they do not necessarily relate to actual conditions in the workplace. Thus protective clothing should be selected with a full appreciation of the conditions and tasks related to the end-user process, taking account of the risks involved and of the data supplied by the manufacturer in relation to the performance of the protective clothing against the hazard or hazards in question.

4 GENERAL REQUIREMENTS

4.1 Size Designation

4.1.1 In the size designation of protective clothing (excluding hand-, head- and foot-protective equipment), measurements have been so specified that they will define the body size.

4.1.2 Measure the body in accordance with IS 14453. The arm length is the distance between the wrist and the highest point of the arm ball on the edge of the shoulder, measured on top of the arm with the arm hanging straight.

4.1.3 The control dimensions for protective clothing shall be height, chest or bust girth, and waist girth.

4.1.4 The size designation of each garment shall comprise at least two control dimensions, in cm. These two control dimensions shall be either the height and chest or bust girth; or the height and the waist girth. The height and the girth ranges shall be as given in Table 1.

Table 1 Height and Girth Ranges of Body Measurements

All dimensions in centimetres.

Sl No. (1)	Height (2)	Chest or Bust Girth (3)	Waist Girth (4)
i)	152-158	76-80	56-60
ii)	158-164	80-84	60-64
iii)	164-170	84-88	64-68
iv)	170-176	88-92	68-72
v)	176-182	92-96	72-76
vi)	182-188	96-100	76-80
vii)	188-194	100-104	80-84
viii)	—	104-108	84-88
ix)	—	108-112	88-92
x)	—	112-116	92-96
xi)	—	116-120	96-100
xii)	—	120-124	100-104
xiii)	—	—	104-108
xiv)	—	—	108-112
xv)	—	—	112-116

NOTE — The ranges in Table 1 may be used in any combination. The total range of these values may be enlarged by using the above mentioned appropriate intervals (for example, height 194–200). For garments manufactured in a few sizes only, the appropriate size shall be indicated by combining several body size intervals (for example, height 170–194). The manufacturer can also designate additional measurements (for example, arm length, inside leg length). The value shall correspond to the actual length expressed in cm.

4.1.5 The standard pictogram according to IS 14453 shall be used as a means of indicating the size.

4.1.6 Height, chest or bust girth and waist girth shall be designated as range expressed in cm. The arm length and inside leg length shall be a single value.

4.1.7 Examples of size designation are shown in Annex A.

4.2 Dimensional Change

4.2.1 The representative samples of protective clothing shall be washed or dry cleaned as applicable in accordance with **4.2.1.1** or **4.2.1.2** and the percentage dimensional change along warp and weft directions calculated as the ratio of the change in dimension and the original dimension multiplied by 100 shall be 3 percent, maximum in each of the warp and the weft direction.

4.2.1.1 The sample shall be subjected to the wash procedure as per manufacturer's instructions on the care label supplied with the clothing in front loading machine or otherwise to a standard wash procedure according to Method 6A (40 ± 3°C) and flat dried in accordance with method C of IS 15370.

4.2.1.2 If the clothing is required to be dry cleaned as per manufacturer's instructions or it is adversely affected by washing, the representative sample of the clothing shall be subjected to dry cleaning procedure in accordance with Annex C of IS 15612 (Part 2).

5 PERFORMANCE REQUIREMENTS

5.1 General

The protective clothing shall meet the limited flame spread requirement (code letter A) and at least one other heat transmission performance requirement (code letters B to E) at level 1 or above.

5.2 Limited Flame Spread (Code Letter A)

5.2.1 *Pre-treatment*

5.2.1.1 The protective clothing shall be tested both before and after a cleansing procedure, in accordance with **5.2.1.2**.

5.2.1.2 The sample shall be submitted to at least five wash cycles of the cleansing procedure as per manufacturer's instructions. If no cleansing procedure is prescribed, the material shall be submitted to twelve wash cycles of one of the standard cleansing procedures prescribed in **5.2.1.3** or **5.2.1.4** as appropriate to the fabric.

5.2.1.3 Standard wash procedure according to Method 6A (40 ± 3° C) and flat dried in accordance with method C of IS 15370.

5.2.1.4 The protective clothing other than those covered in **5.2.1.3** which are adversely affected by washing, shall be tested after water soaking in accordance with the procedure described in Annex D of IS 12467 (Part 2) followed by five dry cleaning cycles in accordance with the procedure specified in Annex C of IS 15612 (Part 2).

5.2.2 *Testing and Performance Requirements*

When tested in accordance with IS 15758 (Part 3) after the pretreatment specified in **5.2.1**, all outer materials or clothing assemblies shall meet the following requirements:

a) No specimen shall give flaming to the top or either side edge;
b) No specimen shall give hole formation;
c) No specimen shall give flaming or molten debris. The mean value of after flame time shall not exceed 2 s; and
d) Mean value of afterglow time shall not exceed 2 s.

5.3 Convective Heat — Heat Transmission Index (Code Letter B)

When tested in accordance with IS 15758 (Part 1) all clothing assemblies which are claimed to offer protection against convective heat shall meet at least performance level B1 as specified in Table 2. The level of performance shall be indicated by the band number B1 to B5 specified in Table 2.

Table 2 Performance Levels — Convective Heat

Sl No.	Performance Level	Range of HTI Values	
		Minimum	Maximum
(1)	(2)	(3)	(4)
i)	B1	3	6
ii)	B2	7	12
iii)	B3	13	20
iv)	B4	21	30
v)	B5	31and above	

5.4 Radiant Heat (Code Letter C)

When tested in accordance with IS 15758 (Part 2) Method B at a heat flux density of 20 kW/m^2, all clothing assemblies which are claimed to offer protection against radiant heat shall meet at least level C1 as specified in Table 3. Tests on metallized materials shall be carried out after pretreatment as specified in Annex B of this standard. The level of performance shall be indicated by the band number C1 to C4 as specified in Table 3.

Table 3 Performance Levels — Radiant Heat

Sl No.	Performance Level	Mean Time to Level t_2	
		Minimum	Maximum
(1)	(2)	(3)	(4)
i)	C1	8	30
ii)	C2	31	90
iii)	C3	91	150
iv)	C4	151 and above	

5.5 Molten Aluminium Splash (Code Letter D)

When tested in accordance with IS 15758 (Part 5) using molten aluminium all clothing assemblies which are claimed to offer protection against molten aluminium splash shall meet at least level D1 as specified in Table 4. The level of performance shall be indicated by the band number D1 to D3 as specified in Table 4.

Table 4 Performance Levels — Molten Aluminium Splash

Sl No.	Performance Level	Molten Aluminium Splash Index, g	
		Minimum	Maximum
(1)	(2)	(3)	(4)
i)	D1	100	200
ii)	D2	201	350
iii)	D3	351 and above	

5.6 Molten Iron Splash (Code Letter E)

When tested in accordance with IS 15758 (Part 5) using molten iron all clothing assemblies which are claimed to offer protection against molten iron splash shall meet at least level El as specified in Table 5. The level of performance shall be indicated by the band number El to E3 as specified in Table 5.

Table 5 Performance Levels — Molten Iron Splash

Sl No.	Performance Level	Molten Iron Splash Index, g	
		Minimum	Maximum
(1)	(2)	(3)	(4)
i)	E1	60	120
ii)	E2	121	200
iii)	E3	201and above	

NOTES

1 The end point of testing in IS 15758 (Part 5) is when four successive tests on fresh specimens using the same weight of molten metal show no damage to the PVC film. Therefore, to ensure that a material meets the requirements for a particular performance level, it is sufficient to conduct four tests using a weight of metal corresponding to the lower limit of the grade and to obtain no damage to the PVC film in all four tests.

2 Acceptable performance in IS 15758 (Part 5) against molten aluminium will normally ensure that a material will be acceptable against molten aluminium bronze and molten minerals.

3 Acceptable performance in IS 15758 (Part 5) against molten iron will normally ensure that a material will be acceptable against molten copper, molten phosphor bronze and molten brass.

5.7 Additional Garment Requirements

The garments designed to offer protection against molten metal splash shall meet the following features:

a) Jackets shall be long enough to cover the tops of the trousers even when the wearer is bending over;
b) Trouser bottoms shall be long and wide enough to overlap the top of the footwear and shall have no turn ups;
c) External pockets on jackets and overalls, where provided, shall be covered by flaps at least 20 mm wider than the pockets to avoid the flap being tucked into the pocket;

d) Overlapping seams on the outside of the garments shall be downward facing and over locked;
e) Any metal fasteners on the outside of the garments shall be covered or treated to avoid the adhesion of molten metal;
f) Quick release fastenings shall be provided to enable rapid removal in an emergency; and
g) Reinforced protection should be considered for the crotch area, shoulders and collar.

6 DESIGN AND CONSTRUCTIONAL REQUIREMENTS

Protective clothing shall be designed and manufactured as follows:

a) The materials and components of protective clothing shall not adversely affect the wearer.
b) It shall offer the wearer the best possible degree of comfort that is consistent with the provision of adequate protection.
c) Parts of the protective clothing that can come into contact with the user shall be free of roughness, sharp edges and projections that could cause excessive irritation or injuries.
d) Its design shall facilitate its correct positioning on the user and shall ensure that it remains in place for the foreseeable period of use, taking in to account ambient factors, together with the movements and postures that the wearer could adopt during the course of work. For this purpose, appropriate means, such as adequate adjustment systems or adequate size ranges, shall be provided so as to enable protective clothing to be adapted to the morphology of the user.
e) It shall be as light in weight as possible without prejudice to the design strength and efficiency.
f) Where applicable, protective clothing design shall take into account other items of protective clothing or equipment which must be worn to form an overall protective ensemble the same level of protection shall be provided at interface areas, such as sleeve to glove, trouser cuff to footwear and hood to respirator.

7 MARKING

The marking shall be complete, clear and precise. Each piece of protective clothing shall be marked with the following information on the product itself or on durable and securely attached labels:

a) Name, address or trade-mark or other identification means of the manufacturer;
b) Date of manufacture and/or batch number;
c) Type designation, trade name or code for clear identification;
d) Size designation according to **4.1.1** to **4.1.7**;
e) Pictogram as shown in Fig. 1, incorporating the number of this Indian Standard and the performance levels recorded for property A (limited flame spread) and at least one of the other properties at B to E; and
f) For care labelling, washing and cleaning instructions shall be given in accordance with IS 14453.

NOTES

1 The code letters A to E correspond to the various properties listed in **5.2** to **5.6**.

2 Limited flame spread properties (A) are always recorded. Only those additional properties which are appropriate and have been tested are included on the pictogram.

3 Each letter used is followed by a number indicating the level of performance achieved. Number 1 indicates the lowest level of performance which is acceptable.

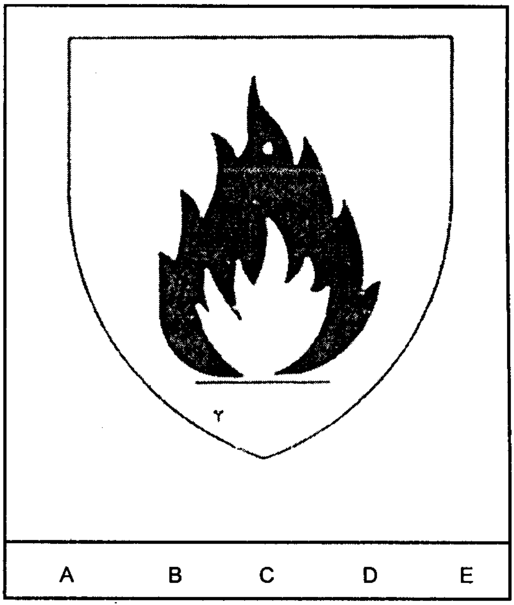


FIG. 1 PICTOGRAM — CLOTHING FOR PROTECTION AGAINST HEAT AND FLAMES

8 MANUFACTURER'S INFORMATION

Protective clothing shall be supplied to the customer with information written at least in the official language(s) of the country of destination. All information shall be unambiguous. The following information shall be given:

a) Name and full address of the manufacturer and/or authorized representative;

b) Product designation as specified in **4.1.1** to **4.1.7**;

c) Explanation of any pictograms and level of performance, together with a basic explanation of the tests that have been applied to the protective clothing and a corresponding list of performance levels, preferably in a table of performance;

d) Instructions for use:

  1) tests to be carried out by the wearer before use, if required;
  2) fitting; how to put on and off, if relevant;
  3) application; provide basic information on possible uses and, where detailed information is available, state the source;
  4) limitations on use (for example temperature range, etc);
  5) instruction for cleaning and/or decontamination;
  6) if appropriate, warnings against problems likely to be encountered; and
  7) if helpful, illustrations, part numbers, etc shall be added;

e) Reference to accessories and spare parts, if relevant; and

f) The type of packaging suitable for transport, if relevant.

9 INSTRUCTIONS FOR USE

9.1 General

The provision of protective clothing shall be accompanied by adequate information for proper use. All information shall be precise and understandable and shall be written in the language of the member state or in the regional language.

9.2 Explanation of Marking

The instructions shall include an explanation of the marking system (*see* **8**). They shall provide basic information concerning areas of application, including detailed information on the performance levels achieved in **6**, together with the source and significance of the test information. They shall also include a warning that the clothing should only be used for the purposes indicated.

9.3 Maintenance and Use

9.3.1 Recommended procedures for cleaning and/or washing shall be given.

9.3.2 A warning shall be included 'Dirty clothing may lead to a reduction in protection'.

9.3.3 The following information shall be given, if appropriate:

a) Special storage requirements; and
b) Instructions for putting on and taking off.

10 PACKING

The protective clothing shall be packed in LDPE film bags having thickness of at least 40 microns or as per the agreement between the buyer and the seller such that it is not adversely affected by the moisture, heat and surroundings.

11 SAMPLING AND CRITERIA FOR CONFORMITY

11.1 Lot

The quantity of protective clothing of same type delivered to a buyer against one dispatch note shall constitute a lot.

11.2 Samples drawn from the lot for testing shall be representative of the material and/or materials as used in the complete garments. Samples may also be cut from garments. They may include features of construction such as seams, joints, or fasteners, if covered by specific requirements.

11.3 The conformity of a lot to the requirements of this specification shall be determined on the basis of the tests carried out on the sample selected from it.

11.4 Unless otherwise agreed to between the buyer and the seller, the number of rolls/ pieces to be selected at random from a lot shall be in accordance with col 2 and 3 of Table 6.

Table 6 Sample Size and Criteria for Conformity

(*Clauses* 11.4 *and* 11.5)

Sl No. (1)	Number of Rolls/ Pieces in the Lot (2)	Number of Rolls/ Pieces to be Selected (3)	Permissible Number of Non-conforming Pieces (4)
i)	Up to 50	5	0
ii)	51-150	8	0
iii)	151-300	13	1
iv)	301-500	20	1
v)	501 and above	32	2

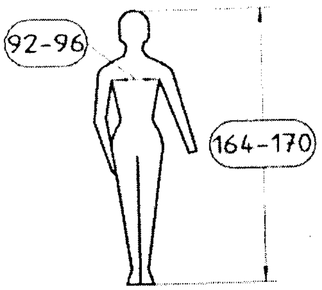
11.5 The number of test samples and the criteria for conformity of a lot for various characteristics shall be as follows:

Characteristics	*Number of Test Samples*	*Criteria for Conformity*
Design and construction, size designation and dimensional change	According to col 3 of Table 6	Non-conforming rolls/pieces shall not exceed the corresponding number given in col 4 of Table 2
Limited flame spread and heat transmission index or radiant heat or molten aluminium splash or molten iron splash	According to col 3 of Table 6	All of the test samples shall satisfy the relevant requirements

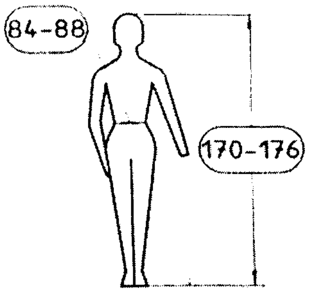
ANNEX A

(*Clause* 4.1.7)

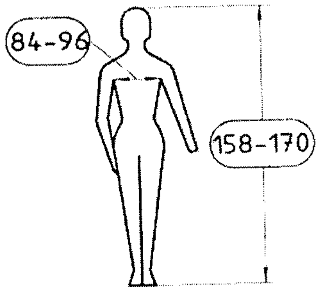
EXAMPLE OF SIZE DESIGNATION FOR PROTECTIVE CLOTHING

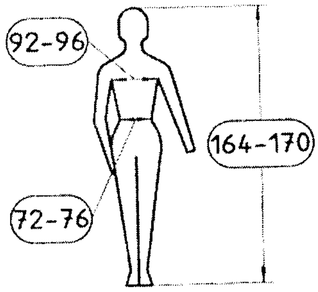


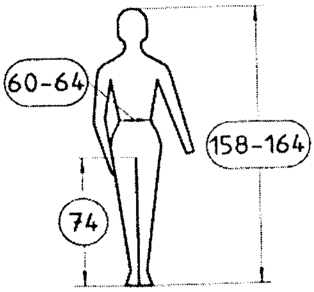
Minimum requirement for suits, jackets and coats

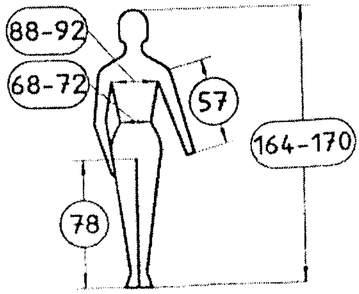


Minimum requirements for trousers









ANNEX B

(*Clause* 5.4)

MECHANICAL PRE-TREATMENT FOR METALLIZED MATERIALS

B-1 PRINCIPLE

The effectiveness of metallized coatings in reflecting radiant heat can be drastically reduced by the effects of wear. This method is designed to simulate the effect of repeated use. Specimens are mechanically pretreated using a test device which simultaneously twists and compresses the specimen.

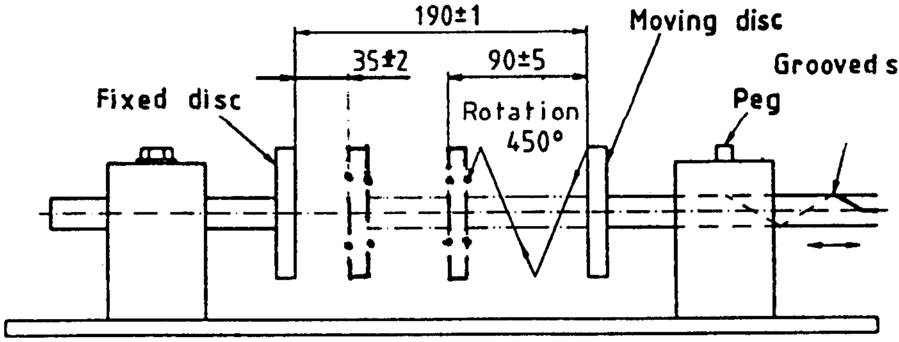
B-2 SAMPLING

Specimens measuring 280 mm × 280 mm are taken from the material or garment. Specimens may include a seam, if it is not possible to take a specimen of the specified size without one.

NOTE — This specimen size is just sufficient to wrap around the circumference of the discs, but overlaps the discs at each end. Only the central portion of the specimen is used for subsequent testing. Thus, two specimens (230 mm × 70 mm) may be taken from each flexed specimen for subsequent testing by IS 15758 (Part 2)

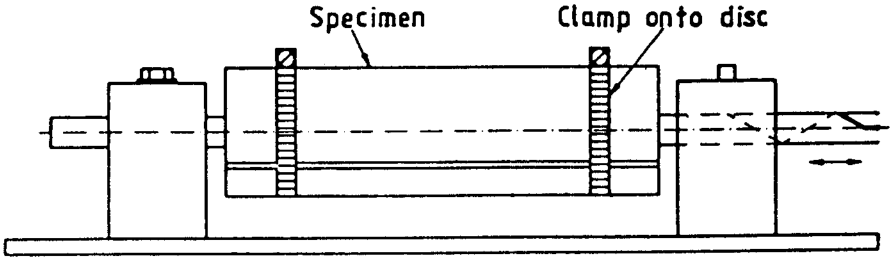
B-3 APPARATUS (*see* Fig. 2)

The test device consists of two discs, 90 ± 1 mm in diameter and 12 ± 0.5 mm thick. One disc is fixed and

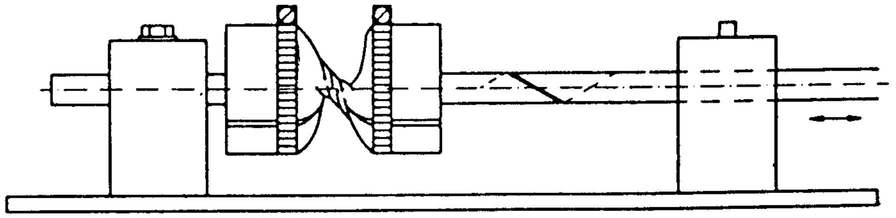


Dimensions in millimetres.

a) Disc movement



b) Initial specimen position



c) Specimen fully compressed

FIG. 2 MECHANICAL PRE-TREATMENT APPARATUS

the other is mounted on a grooved shaft so that it moves towards the fixed disc in two stages:

a) Forward movement of 90 ± 1 mm accompanied by rotation of 450 ± 10°; followed by
b) Forward movement with no rotation.

When the initial disc separation is set at 190 ± 1 mm, the disc separation at the completion of the forward motion shall be 35 ± 2 mm.

The movement of the revolving disc shall be uniform, except during the change from rotary to forward motion and *vice-versa*. One cycle shall comprise one forward and one reverse movement. The device shall complete 40 ± 4 cycles/min.

B-4 PROCEDURE

Adjust the distance between the two discs to 190 ± 1 mm. Attach the specimen to the discs without tensioning it, with the coating facing outwards and the specimen protruding over the edges of the two discs. Subject the specimen to 2 500 cycles. Remove the specimen after every 500 cycles (approximately 12.5 min), rotate it through 90° and reclamp it.

ANNEX C

(*Foreword*)

COMMITTEE COMPOSITION

Chemical Methods of Test Sectional Committee, TXD 05

Organization	*Representative(s)*
Textiles Committee, Mumbai	Dr G. S. Nadigar (***Chairman***) Shri E. Viswambharam (*Alternate*)
Ahmedabad Textile Industry's Research Association, Ahmedabad	Director
Bapuji Institute of Engineering & Technology, Davangere	Dr H. L. Vijaykumar Dr K. Murugesh Babu (*Alternate*)
Central Institute for Research on Cotton Technology, Mumbai	Dr (Ms) C.R. Raje Dr R. H. Balasubramanya (*Alternate*)
Central Pollution Control Board, Delhi	Dr M. Q. Ansari Shri Ajay Aggarwal (*Alternate*)
Clariant India Ltd, Mumbai	Dr V. G. Nayak
Directorate of Standardization (Production & Supplies), New Delhi	Lt-Col (Dr) R. Srivastava Lt-Cdr B. Manjunath (*Alternate*)
Indian Institute of Carpet Technology, Bhadohi	Prof (Dr) K. K. Goswami Shrimati Betty Das Gupta (*Alternate*)
Indian Jute Industries' Research Association, Kolkata	Shri A. K. Banerjee
Jaya Shree Textiles, Rishra	Shri Abhey Nair Shri Pawan Sharma (*Alternate*)
L. N. Chemical Industries, Mumbai	Shri Ketan L. Gandhi
Maniklal Verma Textile Institute, Bhilwara	Dr N. K. Mathur
Man-Made Textile Research Association, Surat	Dr Sandeep R. Naik Shri M.G. Patel (*Alternate*)
Ministry of Defence (DGQA), Kanpur	Lt-Col P. P. Naidu Shri Rama Yadav (*Alternate*)
Ministry of Defence (R&D), Kanpur	Ms Archana Vyas Ms Priyanka Katiyar (*Alternate*)

Organization	*Representative(s)*
Office of the Textile Commissioner, Mumbai	Shri R. A. Lal
Premier Colorscan Instruments Pvt Ltd, Thane	Shri Raymond Ramrajkar Shri D. I. Desai (*Alternate*)
Rajasthan Spinning and Weaving Mills Ltd, Noida	Shri K. D. Joshi Shri Vijay Yadav (*Alternate*)
Reliance Industries Ltd, New Delhi	Shri P. K. Badami Shri Sanjeev Israni (*Alternate*)
SNDT Women's University, Mumbai	Dr (Ms) Bharati A. Patwardhan
Suditi Industries Ltd, Mumbai	Shri R. Chinraj Shri Rajendra Gaikwad (*Alternate*)
Sunil Industries Ltd, Mumbai	Shri Vinod G. Lath Shri Ramesh Khanna (*Alternate*)
Texan Lab, Mumbai	Shri Ullhas Nimkar Shri Rahul Bhajekar (*Alternate*)
Textiles & Engineering Institute, Ichalkaranji	Prof S. K. Laga Prof S. S. Chinchwade (*Alternate*)
The Bombay Millowner's Association, Mumbai	Shri Mahesh Sharma
The Bombay Textile Research Association, Mumbai	Shri B. S. Acharya Shri P. R. Mistry (*Alternate*)
The South India Textile Research Association, Coimbatore	Shri D. Balasubramanian
The Synthetics & Art Silk Mills' Research Association, Mumbai	Shri K. S. Taraporewala Shri D. L. Shah (*Alternate*)
University Department of Chemical Technology, Mumbai	Prof M. D. Teli Prof S. R. Shukla (*Alternate*)
Veermata Jeejabai Technological Institute, Mumbai	Prof K. D. Gawand
Wool Research Association, Thane	Smt G. P. Rane Shri V. C. Panse (*Alternate*)
In personal capacity (*2 Siddhi Vinayak Cooperative Group Housing Society, Swatantrya Veer Savarkar Marg, Prabhadevi, Dadar, Mumbai*)	Shri M. D. Dixit
BIS Directorate General	Director and Head (TXD) [Representing Director General (*Ex-officio*)]

Member Secretary
Shri M. S. Verma
Director and Head (TXD), BIS

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act,* 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards : Monthly Additions'.

This Indian Standard has been developed from Doc : No. TXD 05 (0771).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002
Telephones : 2323 0131, 2323 3375, 2323 9402

Telegrams : Manaksanstha
(Common to all offices)

Regional Offices : Telephone

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg
NEW DELHI 110 002 — 2323 7617, 2323 3841

Eastern : 1/14 C.I.T. Scheme VII M, V. I. P. Road, Kankurgachi
KOLKATA 700 054 — 2337 8499, 2337 8561, 2337 8626, 2337 9120

Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160 022 — 260 3843, 260 9285

Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600 113 — 2254 1216, 2254 1442, 2254 2519, 2254 2315

Western : Manakalaya, E9 MIDC, Marol, Andheri (East)
MUMBAI 400 093 — 2832 9295, 2832 7858, 2832 7891, 2832 7892

Branches : AHMEDABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. NAGPUR. PARWANOO. PATNA. PUNE. RAJKOT. THIRUVANANTHAPURAM. VISAKHAPATNAM.

Printed at Sunshine Graphics